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IS 10386-2 (1982): Safety in Construction, Operation and Maintenance of River Valley Projects, Part II: Amenities, Protective Clothing and Equipment [WRD 21: Safety in Construction, Operation and Maintenance of River Valley Projects]



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“Knowledge is such a treasure which cannot be stolen”



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*Indian Standard*

SAFETY IN CONSTRUCTION,  
OPERATION AND MAINTENANCE OF  
RIVER VALLEY PROJECTS

PART II AMENITIES, PROTECTIVE CLOTHING AND  
EQUIPMENT

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**INDIAN STANDARDS INSTITUTION**  
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# Indian Standard

## SAFETY IN CONSTRUCTION, OPERATION AND MAINTENANCE OF RIVER VALLEY PROJECTS

### PART II AMENITIES, PROTECTIVE CLOTHING AND EQUIPMENT

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## *Indian Standard*

# SAFETY IN CONSTRUCTION, OPERATION AND MAINTENANCE OF RIVER VALLEY PROJECTS

## PART II AMENITIES, PROTECTIVE CLOTHING AND EQUIPMENT

### 0. FOREWORD

**0.1** This Indian Standard ( Part II ) was adopted by the Indian Standards Institution on 26 November 1982, after the draft finalized by the Safety in Construction, Operation and Maintenance of River Valley Projects Sectional Committee had been approved by the Civil Engineering Division Council.

**0.2** With large scale increase in construction activity, there has also been an increase in the occurrence of accidents on construction jobs. It shall be the overall responsibility of the employer to provide for a safe working environment, as well as to provide safety and health protection to the persons engaged on any construction job.

**0.3** It shall be the responsibility of the employer to initiate and maintain programmes and provide amenities and safety requirements on each construction job in order to reduce or to eliminate hazards of construction activities and also to provide necessary first aid facilities as well as ambulance van for prompt transportation of the injured persons to a physician or hospital. The project authorities shall ensure the availability of medical personnel for advice and consultation on matters of occupational health and shall make necessary arrangements for prompt medical attention in case of serious injury on such account.

**0.4** Each employee shall comply with the different safety provisions and regulations in force on the project and shall remain alert at all times to eliminate hazards to himself or to others.

**0.5** This standard requires reference to the following standards:

IS : 1989 ( Part I )-1978 Leather safety boots and shoes: Part I For miners ( *third revision* )

IS : 2925-1975 Industrial safety helmets ( *first revision* )

IS : 4756-1978 Safety code for tunneling work ( *first revision* )

## **IS : 10386 ( Part II ) - 1982**

IS : 4770-1968 Rubber gloves for electrical purposes

IS : 6994 ( Part I )-1973 Industrial safety gloves: Part I Leather and cotton gloves

IS : 8519-1977 Guide for selection of industrial safety equipment for body protection

IS : 8520-1977 Guide for selection of industrial safety equipment for eye, face and ear protection

IS : 8521 ( Part I )-1977 Industrial safety face shields: Part I With plastics visor

IS : 8523-1977 Respirators, canister type ( gas masks )

IS : 8807-1978 Guide for selection of industrial safety equipment for protection of arms and hands

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### **1. SCOPE**

**1.1** This standard ( Part II ) lays down the requirements covering first aid and medical facilities, occupational health, environmental controls, ventilation, lighting, water supply, drainage, sanitation and personal protective equipment.

### **2. FIRST AID AND MEDICAL FACILITIES**

**2.1** In spite of taking all precautions, accidents may occur during the course of construction. The employer shall, therefore, ensure the availability of suitable arrangements at every work-site for rendering prompt and efficient first aid to injured persons. Proper equipment for prompt transportation of the injured persons to a physician or a hospital shall also be provided. The telephone numbers of the physician, hospital or ambulance shall be conspicuously pasted at each work-site. First aid kits shall be provided at accessible points in the ratio of at least one kit for 25 employees. In the absence of clinic, hospital or physician, reasonably accessible, in terms of time and distance, to the work-site, at least one person who has a valid certificate in first aid training shall be available at each work-site to render first aid. For this purpose, standard first aid kits approved by the medical officer incharge of project shall be available at the work site. To readily locate the first aid station, adequate identification and directional marks shall be provided. An emergency alarm shall also be provided for all first aid stations. Under no circumstances shall a rescuer enter the site, to remove a victim of over exposure due to the presence of dangerous gases/vapours, without proper respiratory protection.



**2.2** The safety organization of the project, under the advice of the medical officer incharge of the project, shall be responsible for issuing instructions/training on the first aid practices to be followed.

**2.3** In case of special jobs, such as, working in pneumatic lock or other similar conditions where the workmen are subjected to higher pressures, either in pneumatic sinking of wells or in the working of tunnel shields under pneumatic pressure, detailed special specifications for de-compression chambers and other special devices shall be made in the safety requirements under the contract. At least one person trained by the medical officer incharge shall be available in each shift at each working point, having special training with respect to medical aid in dangers arising out of working under pressures.

### **3. OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROLS**

**3.1** The employer shall ensure that regulations and environmental controls, applicable to any work environment, intended for controlling and eliminating hazards to a worker's health and safety are followed at all times.

**3.2** When hazardous substances such as dust, fumes, mists, vapours or gases exist, or are produced in the course of construction, such as, site clearing or demolition, handling of corrosive materials, grinding, spraying, etc, their concentration shall not be allowed to exceed the specified limits and all reasonably practical measures shall be taken to prevent inhalation, ingestion or skin absorption of these hazardous substances. To achieve this, engineering controls shall be implemented whenever feasible and appropriate respiratory protective devices shall be provided to the workers and shall be used where necessary. Adequate washing facilities for employees engaged in the application of paint, coating, herbicide or insecticide, or in other operations where contaminants may be considered harmful, shall be provided at the work-site to enable employees to remove such harmful substances from their hands and body before leaving the work-site.

#### **3.3 Dust Elimination**

**3.3.1** In case of haul and access roads, the road surfaces shall be kept moist.

**3.3.2** In case of concrete batching and mixing plant and in places where the handling of cement is done manually, masks shall be provided to the workers.

**3.3.3** For tunnels, exhaust fans shall be provided.

**3.4** Protection against the effects of noise exposure shall be provided when the sound levels exceed the prescribed limits. When employees are

subjected to sound levels exceeding the prescribed limits, feasible engineering controls shall be utilized and, if necessary, personal protective equipment shall also be provided and to minimize the effect of excessive sound levels.

**3.5** In construction and related activities, involving the use of sources of ionizing radiations, the pertinent provisions of the Atomic Energy Commission shall be strictly followed.

**3.6** Drinking of alcoholic beverages shall be prohibited. Employees under the influence of any intoxicating beverages, even to the slightest degree, shall not be permitted to remain at work.

#### **4. VENTILATION AND LIGHTING**

**4.1** Workmen shall be provided with ample supply of fresh air to maintain their health and safety at all times. The ventilation system shall be adequate to maintain supply of pure air and if natural circulation is not adequate artificial ventilation shall be provided. Ventilation shall be sufficient to carry away harmful accumulation of dust and fumes. Oxygen content of the atmosphere in the working area/space shall be determined by pre-entry and subsequent tests made with approved instruments such as fyrite gas analysers. No one shall enter or remain in a working area/space when tests indicate presence of oxygen less than 19.5 percent by volume in its atmosphere unless he wears approved respiratory protective equipment, such as, fresh air hose mask or self contained breathing apparatus. In case, presence of dangerous gases is indicated, the working area shall be examined for dangerous gases within 2 hours before the work is begun and after every 2 hours during the working shift. Whenever, there is a rockfall in the underground works, the safety measures shall be adopted, even if proportions of dangerous gases are within permissible limits. Air shall be considered unfit for workmen to breath if it contains any of the following:

- a) Less than 19.5 percent by volume of oxygen,
- b) More than 0.5 percent by volume of carbon dioxide,
- c) More than 0.005 percent by volume of carbon monoxide,
- d) More than 0.001 percent by volume of hydrogen sulphide,
- e) More than 0.002 percent by volume of oxides of hydrogen,
- f) More than 0.5 percent by volume of methane,
- g) More than 1.50 percent by volume of flammable gases, and
- h) Any other poisonous gas in harmful amounts.

**4.2** Construction areas, aisles, stairs, ramps, runways, corridors, offices and shops where work is in progress, shall be adequately lighted with either natural or artificial illumination. Inadequate lighting of working areas

is by itself a source of danger, particularly where work is undertaken at night. The minimum illumination intensities as given in Table 1, shall be provided while any work is in progress:

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**TABLE 1 MINIMUM ILLUMINATION INTENSITIES**

IN LUX ( lx )	AREA OF OPERATION
54	General construction areas; concrete placement, excavation and waste areas; accessways; active storage areas; loading platforms; refueling and field maintenance areas.
54	Indoors; warehouses, corridors, hallways and exitways.
54	Tunnels, shaft and general underground work areas; ( Except that minimum of 108 lux is required at tunnel and shaft heading during drilling, mucking and scaling ).
108	General construction plant and shops ( for example, batch plants, screening plants, mechanical and electrical equipment rooms, carpenter shops, rigging lofts, active store rooms, barracks or living quarters, locker or dressing rooms, mess halls, and indoor workrooms ).
325	First aid stations, infirmaries and offices.

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## 5. WATER SUPPLY, DRAINAGE AND SANITATION

**5.1** Adequate supply of potable water shall be provided in all places of employment. The potable drinking water shall be provided from sources meeting central, state or local health requirements. Outlets for non-potable water, such as water used for construction, industrial or fire fighting purposes, shall be identified by signs to indicate clearly that the water is unsafe and is not to be used for drinking, washing or cooking purposes. There shall be no cross-connection, open or potential, between a system furnishing potable and a system furnishing non-potable water.

**5.2** Disposal of waste material or debris shall comply with local regulations. All waste material and rubbish shall be removed from the work areas as the work progresses. Adequate scavenging arrangements shall be provided to maintain clean surroundings at all times. Refuse containers shall be placed at convenient points.

**5.3** Adequate number of toilets and washing facilities shall be provided for employees working at different construction sites to comply with local regulations. Similarly, adequate number of wash basins and drinking water taps with proper drainage arrangements, shall be provided for each job-site. For workers employed in the construction of tunnels or shafts, dry closets or water closets or closet cars shall be provided in the tunnel at the scale of one unit for each 40 men in the shift. Closets shall be effectively and regularly cleaned and disinfected.

**5.4** Provision for water supply, drainage and sanitation for residential and other type of buildings at a projects shall follow the standards for temporary structures at project sites.

## **6. PERSONAL PROTECTIVE EQUIPMENT**

**6.1** All employees, including equipment operators and mechanics, entering hard hat areas; which shall include all locations where construction work of any nature is in progress, and shall encompass the entire job site with exception of interior of shops, offices and parking areas, shall wear hard hats or helmets. Hard-toed boots or shoes shall be used where protection of feet is required. The helmets and hard-toed shoes shall meet the specification laid down in the various Indian Standards for such head and feet protection equipment. Similarly, the employees shall be provided with safety devices for protection of eyes, ears, face and neck from physical, chemical, radiation and other hazards during welding and similar operations. The employer shall be responsible for enforcing the wearing of proper personal protective equipment in all operations where there is exposure to hazardous conditions. Regulations governing the use, selection and maintenance of such personal protective equipment shall be followed. Immediately before starting the work, the protective equipment shall be thoroughly examined to see whether the same is in sound condition. Under no circumstances shall a person work with unsound personal protective equipment.

**6.2** Apart from wearing of hard hats or helmets and hard-toed shoes in the hard hat areas ( *see 6.1* ), which is obligatory, it shall be the responsibility of the employer to enforce wearing of other personal protective equipment like safety belts, safety goggles, respirators, gloves, ear protection, etc, during different operations needing any of the above protective equipment for safety of the workers. The use of standard personal protective equipment as occasioned by the type of work shall be made obligatory. The protective equipment required will no doubt vary with the size, nature and location of the operation, however, its selection shall follow the standards and specifications laid down in different Indian Standards for different kinds of job. It shall be light for convenience in use and strong to withstand rough service. Similarly, all tools shall have the required in built safety measures needed for use at various jobs. All motor vehicles and other construction equipment shall be provided with safety measures like seat belts, anchorages, guard rails, tee boards, etc. A driver's seat shall be of such design, construction and dimensions as shall permit safe operation of the machinery without undue fatigue and discomfort to the driver.

**6.3** For workers engaged on cement handling, wearing of full length clothes, tight eye goggles and respirators shall be made obligatory. Hand cream or petroleum jelly shall also be provided for the their use, as protection against cement dermatitis. Employees working with steel

reinforcement shall be provided with a leather or heavy denim apron and heavy hand gloves or hand pads, in addition to safety belts and suitable head gear. During concreting, the workers shall use hard hats and rubber boots. Spray gun operators shall be required to wear gloves, goggles and respirators. Workers handling paint and creosoted materials shall apply protective creams on the exposed skin before exposing themselves to paint and creosote.

**6.4** Gloves of a suitable type shall be worn by all employees when required to handle wire ropes, steel cables or other rough and sharp edged materials, leather or asbestos gloves shall be preferred for welding operations. Goggles shall be worn when grinding, chipping, scrapping, caulking, cutting and heating rivets. Employees, when working in areas in which a potential exposure to direct or reflected-laser light exists, shall be provided with antilaser eye protection devices. Areas in which lasers are used, shall be posted with standard laser warning placards.

**6.5** Safety shoes shall be worn by workers engaged in for structural steel erection work. Safety shoes shall also be worn when working in shops or other places where materials are likely to fall on the feet. The tunnel workers shall be provided with hard-toed shoes. For very heavy work, fire resistant laggings and high boots shall be used.

**6.6** When working near or over an opening where there is danger of falling, a safety belt shall be worn by workers. Safety life belts and life lines shall also be provided when working on scaffolds, in hoppers or on high piles of loose material.

**6.7** The sand blast operators shall wear an approved sand blaster's hood as well as goggles and other protective clothings. All workmen working in the vicinity of sand blasting, grinding, etc, shall also be provided with goggles and respirators.

**6.8** Persons before entering a magazine shall put on magazine shoes without nails, which shall be kept at all times in the magazine.

**6.9** Employees, when working around moving machinery, shall not wear loose garments. They shall also cover any loose hair that might be caught by moving parts. No loose garments or ragged clothing shall be worn by the persons engaged in the tunneling operations. During welding operations, the sleeves and collars shall be kept buttoned up and pockets eliminated from the front of overalls and aprons. Trousers or overalls shall not be turned up on the outside. The clothing shall be free from grease, gasoline, oil and other flammable materials. Loose clothing with free ends shall not be worn by operators of portable electrical drills, reamers, etc. Smooth overalls shall be worn by them with jumper tucked in. Employees exposed to vehicular traffic shall be provided and shall be instructed to wear warning vests marked with or made of reflectorised or high visibility material.

**6.10** Employees working over or near water, where the danger of falling with risk of drowning exists, shall wear approved life jackets or buoyant work vests. These shall be fully inspected for any defects prior to and after each use. The defective units shall not be used. Suitable rescue equipment shall also be provided and maintained in an efficient state. Walkways and structures extending over or immediately adjacent to water shall be provided with ring buoys of required buoyancy placed at intervals of not more than 50 m. At least one life saving skiff shall be available at locations where employees are working over or adjacent to water. Safety nets shall be provided when the work places are more than 10 m above water surface where the use of ladders, scaffolds, catch platforms, temporary floors or safety lines is impracticable. Such nets shall be of 10 cm mesh and shall be made of Manilla rope at least 1.25 cm diameter, with an outside or border rope of 2 cm diameter. The borders shall be provided with loops so that the nets can be attached to the structure, or to each other.